Case Study: The Airfare Prediction Market

Summary

Customers are frustrated when it comes to booking air travel. It feels like a trap for many people. Most of us know that airfare gets more expensive as the departure date approaches. Many of us also can't commit to plans until closer to the departure date. This leaves customers often giving their best guess at how to get an affordable plane ticket, or gambling that their plans won't change. If plans do change, the customer suffers an expensive change fee, sometimes costing them hundreds of dollars. Or worse yet, the customer ends up having to book a new flight altogether because an alternate fight turns out to be cheaper than the fee. Meanwhile, customers aren't stressing out about hotel rooms and car rentals, because most of those companies allow cancellations within a few days of the reservation. Additionally, most customers when shopping aren't used to dynamic pricing schemes. The price of milk at the grocery store may change slightly, but typically not enough for the customer to cry over spilled milk. Meanwhile, the cost of a plane ticket from Monday to Tuesday could fluctuate by a meaningful amount. This abnormality of the air travel industry is a problem that many startups are seeking to solve: How can we take the guesswork and frustration out of booking airline travel?

Unfortunately, a fixed price structure for the airline industry is unrealistic. No company has found a way to entice customers to pay a higher fixed price when a competitor is offering a lower price. So there is little chance of customers thinking of buying an airline ticket in the same light as they view going to the store to buy milk. Instead, this has pushed the start-ups towards predictive forecasting of airfare pricing. Predictive price forecasting is extremely complex. There

is a data problem, in that the startups need to collect price and availability information from dozens of airlines. This information is also wanted as close to real-time as possible. Then of course they need to normalize this information from many different sources.

Furthermore, there is an analytical hurdle to identify the correct predictors within this information, and questions to ask of this information. How many seats are available? Where is the flight going? What will it cost to buy today? What will it cost to buy next week? How many seats will be available next week? Is there a big conference going on? Is it hurricane season? And the list goes on and on.

Even with all of these hardships present in the predictive pricing arena, 3 companies sought to ease the frustration customers have when booking airline travel. Options Away[1], Flyr[2], and Hopper[3] are three of these companies that predict pricing and availability for flights. Options Away and Flyr go a step further and offer an options market for airline travel, where a customer can purchase the right to buy a flight at current market value at any point until a given future expiration date. If the price of the ticket falls, the customer does not exercise the option and purchases the ticket in a different transaction. If the price of the ticket increases, the customer exercises their option, and these companies cover the increase in price.

To exemplify their differences in this study, I will showcase an example flight from Chicago (CHI) to Washington DC (WAS) on United on March 18 - 21. This study will look at what data is used, what analysis is performed, what tools are exposing their analytics, and predict how these startups will impact they way in which airlines make money in the future.

[1] Options Away. (n.d.). Retrieved from http://www.optionsaway.com/
[2] Flyr. (n.d.). Retrieved from http://www.getflyr.com/
[3] Hopper. (n.d.). Retrieved from http://www.hopper.com/

Case 1 - Options Away

Options Away is a Chicago-based start-up with about $6MM raised in funding. Options Away recognized how hard it is to compete with the major players in the airline industry. How were they going to compete with the likes of Kayak, Expedia, Google, and Priceline? For this reason they decided to focus on a B2B strategy where they provide software as a service to the major players. These services are the predictive pricing and availability models for flights. They do have a direct service to customers via their website, though the lack of mobile app support demonstrates their focus on B2B instead.

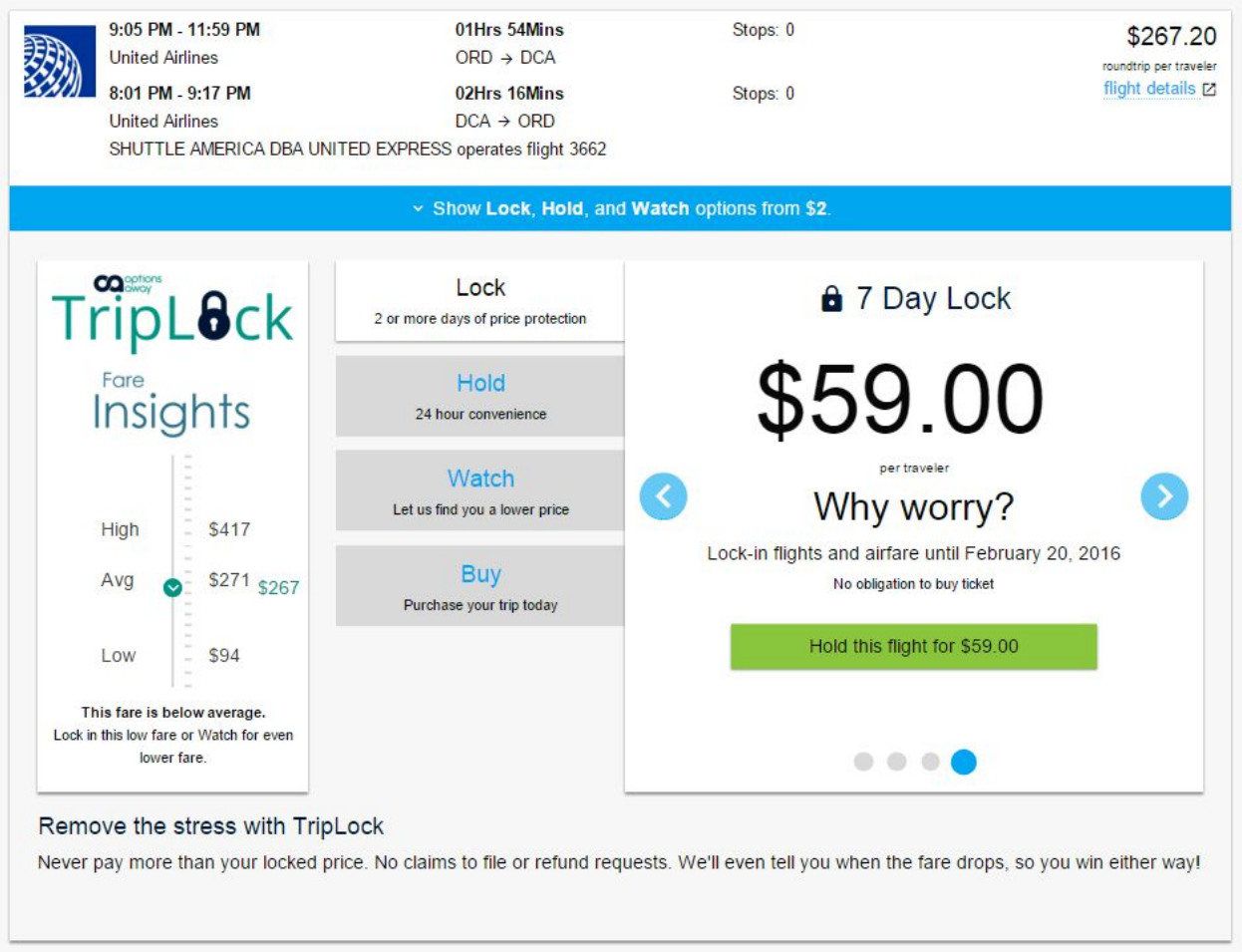
Options Away has scored some major accounts, including American Airlines, Expedia, and Hipmunk. They use their models to advise pricing the airlines should use, and equally important, when to offer those prices. An interesting contradiction to supplying these algorithms, is exposing them to customers on their website. The website will tell you the ideal time to purchase a ticket. Options Away knows that most American Airlines customers won't know to verify the time to buy a ticket on their website, so they don't seem concerned.

While Options Away has scored major accounts, they also are lacking some major accounts. Delta does not appear in their search results. So Options Away at best is only analyzing a fraction of the market.

Options Away has 7 patents on their machine learning algorithms[4]. These algorithms are catered to understanding forecasted prices and seat availability on specific dates. These algorithms take into account things like flight duration, volatility, departure date, available seats, the time of year.

[4] REVIEW: The Options Exchange for Airline Tickets. (n.d.). Retrieved February 19, 2016, from http://blacklinereview.com/review-the-options-exchange-for-airline-tickets/

They also have a culture of experience and commitment to analytics. Top management has extensive experience in financial markets and extensive experience in the travel industry with the COO coming from Orbitz. The foundation of analytic success is baked into the organization from the beginning.



The picture above shows the tools they use to expose the decisions of their algorithms. There are really 3 features here. First is the ‘Fare Insights’ on the left that shows a scale of ticket pricing for the flight. It shows a range of prices you are likely to observe if you check the price everyday. This tool is meant to inform the customer of whether they should wait or not. The second feature is the ‘Lock’ option. Options Away allows you to lock the current ticket price for x

number of days. In the example above, they are offering to lock the price for $59 for the next 7 days. They also offer cheaper options to lock for fewer days. Their 'hold' option is almost a total rip off, because they want you to pay money to hold a ticket for just 24 hours. Yet, domestic airlines allow you to cancel flights at no cost within 24 hours. The third feature is 'Watch and Lock', where you can provide the price you are willing to pay, and Options Away will lock in that fare the moment it becomes available, and alert you to buy the flight. This is a very interesting feature, in that the airlines could look at these bids, and use these bids to influence ticket prices. The volume isn't there to be useful at this point, but it's an interesting concept akin to bidding for flights on Priceline.

Case 2 - Flyr

While the San Francisco based company, Flyr, wouldn't admit this, they are very similar to their competitor, Options Away. They have about $5.34MM in funding[5] (Options Away has $6MM). They also focus on the B2B industry, knowing that the B2C industry in the travel market is too competitive. And likewise, they have web services available to their clients to predict flight prices and seat availability.

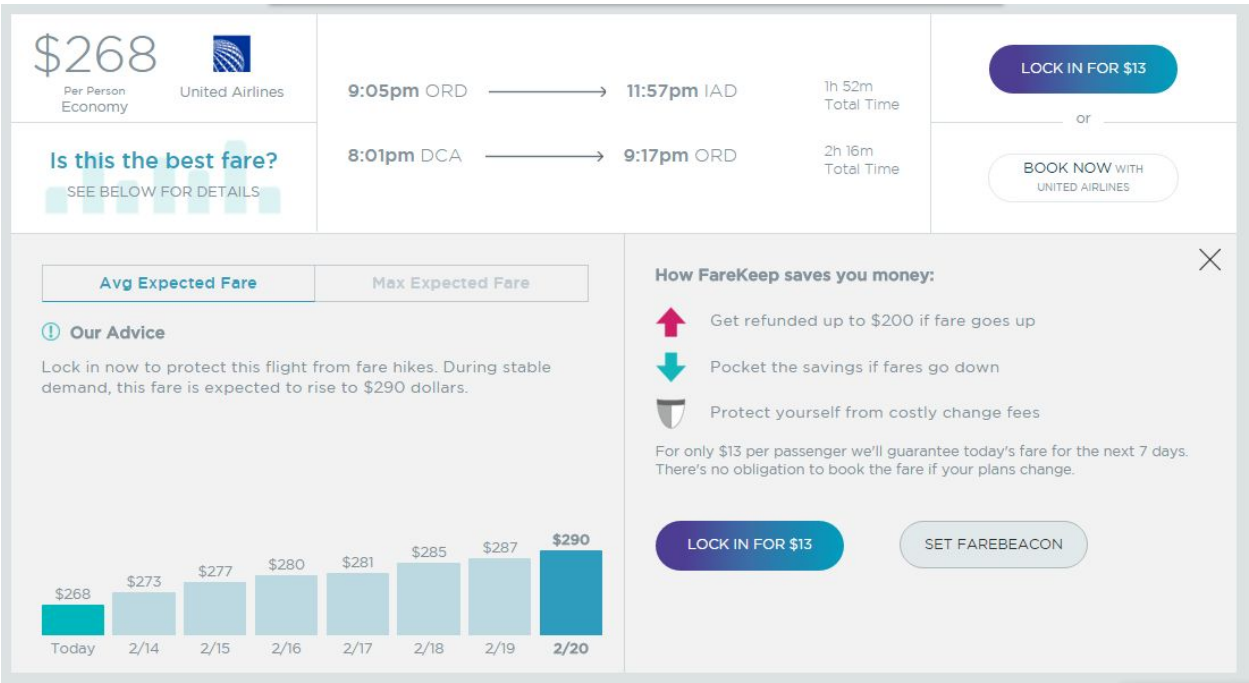
Flyr also has issues with data accumulation. American Airlines does not provide Flyr with flight information, because American Airlines is aligned with Options Away. Meanwhile, Delta is a part of Flyr's results whereas Options Away is missing Delta's flights. Flyr does have integration into many reservation and travel systems, including the Global Distribution System, Travelport, and Airtrade.

Flyr is also committed to having a culture of analytics. Their technology is based on massive databases, machine learning, and scalable technologies.[6] These are mandatory

[5] These are the tools you should be using to book travel. (n.d.). Retrieved February 20, 2016, from http://qz.com/419189/these-are-the-tools-you-should-be-using-to-book-travel/

[6] Enabling The Future Of Travel. (n.d.). Retrieved February 20, 2016, from http://flyrlabs.com/

requirements for a company that's sole purpose is to make money based on offering machine learning services to clients. Their Flyr Labs website showcases their algorithms, methodologies, and the web services they created for their clients. Observing how organized their APIs are demonstrates Flyr's commitment to good development practices that are easily consumable by their business partners.



In the picture above, we see the tools that Flyr offers its customers. First, while Options Away uses a scale to persuade the customer to buy or not buy, Flyr uses a chart (bottom left) showing likely ticket prices for the next several days. The nice thing about this technique is that you really can see the impact of waiting too long. The not-so-nice thing about this technique is that it's hard to show this information for more than a week span without overloading the customer with information. That is where the scale technique would be more fruitful. The second feature is the 'Lock' feature, where for $13 customers can lock in the current ticket price for 7 days. This is much less than the $59 offered on Options Away. This would suggest that either

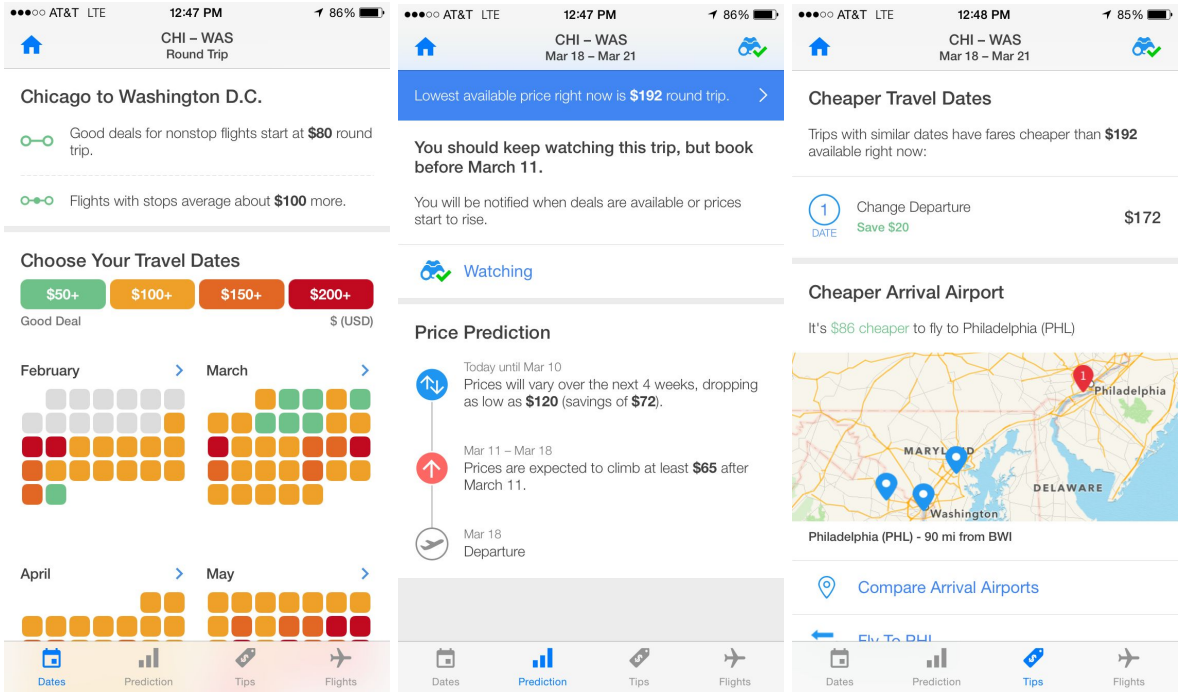
Flyr is more confident about its predictions, or Flyr is more comfortable with risk. Finally, 'Farebeacon' alerts customers not when prices decrease, but instead when Flyr predicts that prices are going to increase or decrease. This is really helpful for customers that want to more passively figure out the best time to purchase a ticket, instead of actively having to check ticket prices often. Or if the customer already purchased an option on a flight, a decrease in price in Farebeacon will alert them to abandon the option and purchase a new flight. Or if the customer has been debating on whether or not to buy a ticket, an impending increase could persuade them to stop waiting.

Case 3 - Hopper

"Launched in 2015, the Hopper app for Android and iOS provides insightful, data-driven research to help travelers make better decisions about where to go and when to fly and buy."[7] This quote from Hopper's mission statement shows the company's commitment to helping customers by exposing the vagaries of ticket pricing. Hopper has taken a different approach to predictive ticket pricing. They want to tackle the B2C space instead of just the B2B space. Interestingly, they are focusing completely on the mobile app space, and do not have a website to mirror the functionality. This may be the reason that they have $22MM in funding as opposed to the $5-6MM in funding for Options Away and Flyr. While B2C is harder to break into, the potential rewards for being successful are reflected in the funding they have.

Hopper, like the others, suffers from a data sparsity issue too. Spirit, Delta, and United show up in results, but the other airlines are missing. It's hard to be a compelling resource for predicting flight prices and availability when so much of the market is not represented in the app yet.

[7] Predict. Watch. Buy. Fly. (n.d.). Retrieved February 20, 2016, from http://www.hopper.com/corp/about.html



Hopper has broken down the booking process into 1. Choose dates, 2. Understand if prices will change, 3. Show alternatives, and 4. Order. This step by step approach is very intuitive and guides the customer. In this process there are 5 important features.

First, it provides a heat map (left in picture) of ticket prices for the route that you chose, in this case Chicago (CHI) to Washington DC (WAS). The heat map provides a quick way for customers to choose exact dates to travel when they have a little flexibility. While this tool does not show off the company's predictive analytics, it showcases a thoughtful tool to help guide customers in the ordering process.It would be beneficial to see a similar version of this map that did include the predictive prices of flights, and show when prices are likely to change. That adds another time dimension to the feature which is understandably hard to communicate easily. The second feature comes after you select dates (center of picture). It is a description of the results of the price analysis, communicated in plain english. It is a simple, buy or wait statement, followed by text that describes why you should wait or buy now. This is in contrast to the graphs

of Options Away and Flyr, where the customer is left to deduce things a bit more for themselves. The third feature is about assessing cheaper alternatives. Hopper shows results for nearby airports and nearby days. This is a very helpful feature to prevent explorative searches that the customer would otherwise had to have done on their own, if they even thought to do it. This a good use of analytics for related searches that save the customer time in the booking process. If you aren't quite ready to book yet, Hopper provides their 'Watcher' option to keep tabs on the date/route the customer is looking to book. The Watch List is a simple list of bookmarked date/routes, using simple language like 'Book Now' or 'Book before March 4' to communicate urgency for the flights the customer is watching. Finally, Hopper provides a means to directly book through their app. This a feature not supported by Options Away and Flyr. This showcases yet again how Hopper is focused on the B2C business, and is looking to create an intuitive and easy-to-use app for its customers.

Analysis of Case Studies

Analytics is not just an important part of predictive airfare companies, it is the foundation of their companies altogether. If they fail to keep up with the price change nuances of the market, and stop predicting pricing accurately, these companies will fail. In order to stay on top of their analytics, they need to review their algorithms continually. They can do as much as possible to find nimble algorithms that take into account as many predictors as possible. But it is really challenging to create an algorithm that can anticipate changes in pricing policies in the airlines, as well as anticipate the multitude of events that could occur. It's likely these companies need to train multiple versions of their pricing and availability algorithms to suite the environment. For example, a recession time algorithm may be created to contrast an algorithm for economic prosperity. Because of the complexity of the pricing schemes, it is crucial that

these companies continually retrain their models, and cater the models to the major environmental settings.

In addition to an analytic foundation that these companies need to be built on, it's important to understand what customers they are striving to attain. Options Away, Flyr, and Hopper all considered the B2B and the B2C markets, starting with the premise that customers should feel more comfortable with their airfare purchases. They are striving to make ticket purchasing more transparent. Options Away and Flyr chose to go the B2B route by offering flight options when purchasing tickets. Hopper chose the B2C route, by exposing predictive information to its customers in an easy-to-understand and consumable format. Interestingly, all 3 companies are asking the same questions of the data they are amassing.

1. What will the price of this ticket be in X days?
2. What will the seat availability be in X days?

While these are two very important questions to figure out, there are 2 more equally important questions to ask, that need to become a focus for these companies. The first has to deal with a major competitive advantage that these companies offer, that they are trying to engage the customer at the beginning of their search experience. These companies are trying to make purchasing flights less frustrating, by taking the guesswork out of figuring out when to purchase a ticket. They are hoping that this feature will draw customers to use their products at the beginning of their search experience, and that they can then hold onto these customers from the very beginning of their search experience. This has the benefit of making their customers loyal to them by engaging them early on, as well as makes customers more willing to commit to a purchase earlier if the customer sees there is no benefit in waiting. Because this is a major competitive advantage of theirs, they should be asking the question, am I engaging customers early, and maintaining them as customers?

They next important question they should be asking of the data pertains to measuring the overall impact of the options market. If the options market becomes successful in its purpose, and alerts customers of the right time to buy an airline ticket, then there would end up being a feedback loop from the options market back to the pricing market. For this reason, it is then important to measure what the impact is of the options market on the airline pricing algorithms. What this really means is that the options market will only really persist if the options are rarely used by customers, so that it never majorly impacts the pricing algorithm. If the pricing algorithms are impacted, then the options market information would become a part of the pricing models, and then eradicates the need for the options market. For these reasons, the only real future for the B2B companies is to be acquired by an airline.

Another major hurdle for these companies is data collection. Much of their data needs to come direct from airlines, or through third party data aggregators. A well-known aggregator in the travel industry is the Global Distribution System, which is a one-stop shop for airlines, hotels, car rentals, etc to coordinate reservations for customers. While Options Away, Flyr, and Hopper use these resources, each company is still only getting a subset of the data they need. The Global Distribution System is diminishing in importance within the travel industry as technology is obsoleting its need. Also, airlines are giving contracts to only some of these predictive airfare companies, leaving the others with a gap in airfare information. For example, American Airlines is present on Options Away, but not on Flyr. While Delta is on Flyr, but not on Options Away. This is extremely limiting to their organizations. They can only model predictions for specific airlines or a subset of the overall market. Even if these players did attain rights to all of the airlines, what would guarantee their rights to this information in the future? This is a rather large issue that should give investors pause.

All 3 companies modelled the same information to understand future ticket prices and availability. Yet when Options Away and Flyr decided to enter the B2B space, they should have updated their models to solve a different problem. Honestly, there is a conflict of interest with offering options in the B2B space. Airlines like options because it is a new revenue stream for them. It's extra money that they can make. And if enough people don't exercise their option, all they need to do is rebook the flight with someone else, meaning it's unlikely the airline would lose out on any airfare. So now airlines want to offer options to get this new revenue stream. Meanwhile, Options Away and Flyr benefit from airlines staying frustrating for customers. This frustration leads to customers buying options. If the options market became effective, the airlines would modify their pricing to accommodate these changes, and obsolete the need for these companies. So Options Away and Flyr have an incentive to keep the market confusing so they can stay in business, or get good enough to be bought out.

There is an inherent conflict of interest with the B2B companies that should reframe the questions they ask of their data. They should be asking how to make the options market profitable for their business partners, instead of being focused on travellers. A proxy for this is measuring pricing and availability, but really they should be focused on airline profits. Hopper meanwhile, being in the B2C space, is asking the right questions of the data, and trying to save the customer the most money. There is no conflict of interest here between the airlines and Hopper. Hopper is working for the customer, and hoping the customer will reward them with loyalty by exposing the mystery behind airfare pricing.

In the end, I see Options Away and Flyr getting bought out by the airlines for the power of their predictive models. Airlines have already shown a lot of interest in the predictive pricing and options space. The fact that some airlines are giving exclusive contracts to these companies demonstrates an interest in acquiring them in the future as well. The future of

Hopper is more nebulous. They have the immense issue of breaking into the B2C space, and to wean customers away from the likes of Kayak, Priceline, and Expedia. With the power of advertising and engaging customers early on in the booking process, they may achieve success.